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Patent Application of

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for

PENETRATION ENHANCING AERODYNAMICALLY FAVORABLE ARROWHEAD.

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BACKGROUND - FIELD OF THE INVENTION

This invention relates generally to arrowheads, and more particularly to aerodynamically favorable arrowheads such as pivotal blade arrowheads and blade-opening arrowheads that have a sharp cutting edge located upon their arrowhead bodies at a location forward of a corresponding main cutting blade cutting edge when in a penetrating configuration such that each arrowhead cuts target material in front of a corresponding main cutting blade when penetrating a target so as to eliminate the frictional drag that the otherwise dull arrowhead bodies would generate with the target before the main cutting blades began cutting target material thereinfront.

~~This application is a continuation in part of my U.S. Patent Application Serial No. 09 / 082 636 filed May 21, 1998, which is incorporated herein by specific reference.~~

BACKGROUND - DESCRIPTION OF PRIOR ART

Arrows have long been used for war, hunting and competitive sports. A conventional arrow has a shaft, a nock at one end that receives the bow string, an arrowhead or point that attaches to the opposite end, and fletchings. The fletchings are glued to the shaft near the nock end, and help to stabilize the arrow in flight by causing it to rotate. Arrowheads generally have a pointed forward end, and an opposite threaded shaft end that attaches the arrowhead to the arrow shaft. Arrowheads are also attached to the forward end of arrow shafts by glueing and other methods.

Arrowheads come in a variety of different sizes and configurations depending on their intended use. For example, there are specifically designed arrowheads for competitive target shooting, shooting fish, hunting birds or small game animals, and for hunting big game animals.

Arrowheads used for hunting kill the game animal by cutting vital organs such as the lungs and vascular vessels such as arteries, which causes rapid hemorrhaging and/or suffocation. Quick and humane kills are dependent on accurate shot placement, and upon the amount or volume of the animal tissue that is cut. Hunting arrowheads that cut more tissue are more lethal, and therefore are better. The volume of tissue that is cut is determined by the cutting diameter of the arrowhead, the number of blades it contains, and by the distance the arrowhead penetrates into the animal. The cutting diameter of an arrowhead is determined by how far each cutting blade extends outward from the arrowhead body. The further the blades extend outward the larger the cutting diameter is, and therefore the more cutting potential the arrowhead has.

A common type of arrowhead used in hunting is the fixed-blade arrowhead, which has a pointed tip end used for penetrating, and generally triangular shaped fixed-blades or non-pivotal blades that each have a razor sharp edge for cutting. Conventional fixed-blade arrowheads blades are held in a fixed position on the arrowhead, and most such blades are replaceable. The replaceable blades attach to the arrowhead body in longitudinal grooves called blade slots. The tip of the arrowhead may be separably attachable to the arrowhead body or may be integral with it.

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Arrowheads for hunting are generally known as broadheads.

Another popular type of arrowhead for hunting is the blade-opening arrowhead. Blade-opening arrowheads are generally known as mechanical broadheads. Blade-opening arrowheads, like conventional fixed-blade arrowheads generally have an elongate arrowhead body, a tip end, and a threaded opposite end. The blades of blade-opening arrowheads have an attachment end which attaches the blades to the arrowhead body by a pivot pin, so that the blades can pivot or rotate in a plane between a closed position and an open position. Blade-opening arrowhead blades are generally an elongate substantially rectangular shape and also have a free non-attached end situated opposite the attachment end. The blades of blade-opening arrowheads are also received in blade slots, which are machined or formed into the side of the arrowhead body. When the pivotal blades of blade-opening arrowheads are retracted or folded into the closed position, a substantial majority of each blade is generally housed within its corresponding blade slot. This feature gives blade-opening arrowheads the ability to attain significantly increased aerodynamic performance over fixed-blade arrowheads, due to the significantly decreased exposure the retracted blades have with the air when the arrow is rotating while in flight. Such increased aerodynamic performance results in the desirable features of: faster shooting arrows, flatter arrow trajectories, increased penetration energy and enhanced repeatability of accuracy, while also providing a wide diameter cut in the game animal when the razor sharp blades open at impact with the animal.

Yet another type of arrowhead used for hunting has pivotal blades that are exposed at a full cutting diameter position while the arrowhead is in-flight. Such arrowheads also generally achieve better aerodynamic performance than fixed-blade arrowheads because by design each pivotal blade only attaches to a corresponding arrowhead body at a single location which therefore with the substantially elongate rectangular shaped blades provides arrowheads having significantly decreased blade surface area exposure with the air while the arrow is in-flight.

It is desirable for an arrowhead to penetrate as deep in the game animal as possible for maximum lethality. The less friction or drag the arrowhead generates or experiences while penetrating a target the further it will penetrate therethrough. The razor sharp cutting edges of arrowheads blades greatly reduce arrowhead penetration friction by slicing with their keen edges.

A major problem associated with conventional pivotal blade arrowheads such as blade-

opening arrowheads is that when in a penetrating or open position such arrowheads do not have a sharp cutting edge exposed from their arrowhead bodies for a considerable amount of their length rearward of the forward leading tip end thereof. This creates a significantly dull forward section of an arrowhead body, which therefore must be pushed or wedged into the target the distance from the leading tip end of the respective arrowhead to the cutting blade before the arrowhead does any cutting. Such a design generates an enormous amount of friction between the dull arrowhead body and target material which unnecessarily and quickly depletes kinetic energy that could of otherwise aided in further target penetration and therefore enhanced lethality.

It is apparent that there is a need for a pivotal blade arrowhead such as a blade-opening arrowhead that when in an penetrating position has a sharp cutting edge exposed at a location forward of the pivotal blade cutting edge so as to slice or cut target material ahead of the pivotal blade and to therefore reduce the friction and drag of the arrowhead while penetrating a target such that both penetration and lethality are maximized.

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SUMMARY OF THE INVENTION

It is an object of the present invention to provide an aerodynamically favorable arrowhead such as a pivotal blade arrowhead that when in a penetrating configuration has at least a section of a sharp cutting edge exposed at a location forward of a main blade cutting edge so as to slice or cut target material ahead of the main cutting blade and to therefore reduce the friction and drag of the arrowhead while penetrating a target such that both penetration and lethality are maximized.

It is another object of the present invention to provide an aerodynamically favorable blade-opening arrowhead that when in a penetrating configuration has at least a section of a sharp cutting edge exposed at a location forward of the pivotal blade cutting edge so as to slice or cut target material ahead of the pivotal blade and to therefore reduce the friction and drag of the arrowhead while penetrating a target such that both penetration and lethality are maximized.

It is still another object of the present invention to provide an aerodynamically favorable arrowhead having a pivotal blade and a fixed-blade such that when in a penetrating configuration at least a section of the sharp cutting edge of the fixed-blade is exposed at a location forward of the pivotal blade cutting edge so as to slice or cut target material ahead of the pivotal blade and to therefore reduce the friction and drag of the arrowhead while penetrating a target such that both penetration and lethality are maximized.

It is yet still another object of the present invention to provide an arrowhead having a pivotal blade and an integral cutting protrusion with a sharp cutting edge exposed thereon such that when in a penetrating configuration at least a section of the sharp cutting edge of the integral cutting protrusion is situated forward of the pivotal blade cutting edge so as to slice or cut target material ahead of the pivotal blade and to therefore reduce the friction and drag of the arrowhead while penetrating a target such that both penetration and lethality are maximized.

It is yet still further another object of the present invention to provide an aerodynamically favorable arrowhead such as a pivotal blade arrowhead that when in a penetrating configuration has an arrowhead body with at least a section of a sharp cutting edge exposed therefrom so as to be located forward of a main blade cutting edge and to slice or cut target material ahead of the main cutting blade and to therefore reduce the friction and drag of the arrowhead while penetrating a target such that both penetration and lethality are maximized.

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The foregoing objects and advantages and other objects and advantages of the present invention are accomplished as according to some of the preferred embodiments of this invention with hunting arrowheads that attach to the forward end of an arrow shaft, where a plurality of blades are pivotally connected to an arrowhead body. When the blades are in a penetrating configuration a plurality of razor sharp cutting edges are exposed at a location upon corresponding arrowhead bodies forward of the pivotal blade cutting edges so as to slice or cut target material ahead of the pivotal blades and to therefore reduce the friction and drag of the arrowhead while penetrating a target such that both penetration and lethality are maximized.

Such an arrowhead as according to one preferred embodiment of this invention is a blade-opening arrowhead that has a fixed-blade removably attachable with its arrowhead body, such that when attached thereto at least a section of the cutting edge of the fixed-blade is situated forward of the cutting edge of a corresponding pivotal blade when the arrowhead is in a penetrating configuration. When the arrowhead is in an in-flight configuration the furthest perpendicular distance from the central longitudinal axis of the arrowhead body to the cutting edge of the fixed-blade is less than the perpendicular distance from the central longitudinal axis of the arrowhead body to the furthest section of the pivotal blade from the central longitudinal axis. Such an arrowhead provides the excellent favorable aerodynamics inherent with blade-opening arrowheads while providing greatly enhanced penetration over conventional blade-opening arrowheads by cutting target material ahead of the pivotal cutting blades and thereby reducing the friction and drag that otherwise would of been generated between the arrowhead body and the target material.

Some arrowhead preferred embodiments as according to this invention having fixed-blades exposed from corresponding arrowhead bodies have substantially flat or planar fixed-blades while other such preferred arrowhead embodiments as according to this invention have fixed-blades with bent portions which aid in their attachment or securement to corresponding arrowhead bodies.

Some arrowhead preferred embodiments as according to this invention having fixed-blades exposed from corresponding arrowhead bodies have substantially removably attachable fixed-blades whereas other such preferred arrowhead embodiments as according to this invention have fixed-blades integral with corresponding arrowhead bodies that are substantially non-removably attached by welding or other similar techniques to their corresponding arrowhead bodies.

Other arrowhead preferred embodiments as according to this invention having at least a section of a cutting edge exposed from corresponding arrowhead bodies at a location forward of the cutting edge of a corresponding main cutting blade when the arrowhead is in a penetrating configuration have at least a linear section of each such cutting edge substantially in coplanar alignment with each other when the arrowhead is in a penetrating configuration whereas other preferred arrowhead embodiments as according to this invention do not.

Yet other arrowhead preferred embodiments as according to this invention have arrowhead bodies that each have at least one integral cutting protrusion formed therewith. Each integral cutting protrusion has a sharp cutting edge exposed thereon such that when the arrowhead is in a penetrating configuration at least a section of the integral cutting protrusion sharp cutting edge is situated forward of the main blade cutting edge. Such designs also provide arrowheads that slice or cut target material ahead of the pivotal blade and therefore reduce the friction and drag of the arrowhead while penetrating a target so as to be an improvement over the prior art.

Still other arrowhead preferred embodiments as according to this invention have pivotal blades that are exposed at a maximum cutting diameter when the arrowheads are in an in-flight configuration. Some such arrowheads are non-blade opening arrowheads whereas some such others are blade-opening arrowheads.

The arrowheads as according to the desired results and scope of this invention are more lethal than prior art conventional arrowheads in that they cut target material ahead of or in front of the arrowhead main cutting blades and therefore reduce the friction and drag of the arrowhead that otherwise would of been generated between the arrowhead body and the target material while penetrating a target such that both penetration and lethality are maximized.

As has been shown in the above discussion, the arrowheads according to this invention overcome deficiencies inherent in prior art arrowheads.

With the above objects and advantages in view, other objects and advantages of the invention will more readily appear as the nature of the invention is better understood, the invention is comprised in the novel construction, combination and assembly of parts hereinafter more fully described, illustrated, and claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **2** is a cross-sectional view of the arrowhead as illustrated in FIG. **1**;

FIG. **3** is a side view of an arrowhead tip as according to this invention;

FIG. **4** is a side view of another arrowhead tip as according to this invention;

FIG. **5** is a side view of an arrowhead tip coupler as according to this invention;

FIG. **6** is a side view of an arrowhead cutting blade as according to this invention;

FIG. **7** is a side view of an arrowhead cutting blade as according to this invention;

FIG. **8** is another partial sectioned side view of the arrowhead as according to this invention as illustrated in FIG. **1**;

FIG. **9** is a cross-sectional view of another arrowhead as according to this invention;

FIG. **10** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **11** is a cross-sectional view of the arrowhead as illustrated in FIG. **10**;

FIG. **12** is a partial length side view of another arrowhead as according to this invention;

FIG. **13** is a cross-sectional view of the arrowhead body of the arrowhead as illustrated in FIG. **12**;

FIG. **14** is a partial length side view of another arrowhead as according to this invention;

FIG. **15** is another partial length side view of the arrowhead as illustrated in FIG. **14**;

FIG. **16** is a cross-sectional view of the arrowhead as illustrated in FIG. **15**;

FIG. **17** is a partial length side view of another arrowhead as according to this invention;

FIG. **18** is another partial length side view of the arrowhead as illustrated in FIG. **17**;

FIG. **19** is a cross-sectional view of the arrowhead as illustrated in FIG. **18**;

FIGS. **20 & 21** are cross-sectional views of other arrowheads as according to this invention;

FIG. **22** is a partial length partial sectioned side view of another arrowhead of this invention;

FIG. **23** is a top view of an annular ring as according to this invention;

FIG. **24** is a side view of an arrowhead cutting blade as according to this invention;

FIG. **25** is a partial length partial sectioned side view of another arrowhead of this invention;

FIG. **26** is a side view of a set screw as according to this invention;

FIG. **27** is a side view of a set screw as according to this invention;

FIG. **28** is a partial length partial sectioned side view of another arrowhead of this invention;

FIG. **29** is a side view of an arrowhead tip as according to this invention;

FIG. **30** is a side view of an arrowhead cutting blade and a set screw as according to this invention;

FIG. **31** is a side view of an arrowhead cutting blade as according to this invention;

FIG. **32** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **33** is a side view of a set screw as according to this invention;

FIG. **34** is a side view of a set screw as according to this invention;

FIG. **35** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **36** is a side view of an arrowhead cutting blade and set screws as according to this invention;

FIG. **37** is a side view of an arrowhead cutting blade as according to this invention;

FIG. **38** is a side view of an arrowhead cutting blade as according to this invention;

FIG. **39** is a side view of an arrowhead cutting blade as according to this invention;

FIG. **40** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **41** is a side view of a set screw as according to this invention;

FIG. **42** is a side view of a set screw as according to this invention;

FIG. **43** is a side view of an arrowhead cutting blade and a set screw as according to this invention;

FIG. **44** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **45** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **46** is a side view of an arrowhead cutting blade and a set screw as according to this invention;

FIG. **47** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **48** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **49** is a cross-sectional view of the arrowhead as illustrated in FIG. **48**;

FIG. **50** is a cross-sectional view of the arrowhead body as illustrated in FIG. **48**;

FIG. **51** is a side view of an arrowhead cutting blade as according to this invention;

FIG. **52** is a cross-sectional view of the cutting blade as illustrated in FIG. **51**;

FIG. **53** is a side view of an arrowhead tip as according to this invention;

FIG. **54** is an enlarged perspective view of the arrowhead cutting blade of FIGS. **51 & 52**;

FIG. **55** is a cross-sectional view an arrowhead as according to this invention;

FIG. **56** is a cross-sectional view of a cutting blade of the arrowhead as illustrated in FIG. **55**;

FIG. **57** is a cross-sectional view of the arrowhead body of the arrowhead as illustrated in FIG. **55**;

FIG. **58** is a cross-sectional view an arrowhead as according to this invention;

FIG. **59** is a cross-sectional view of a cutting blade of the arrowhead as illustrated in FIG. **58**;

FIG. **60** is a cross-sectional view of the arrowhead body of the arrowhead as illustrated in FIG. **58**;

FIG. **61** is a cross-sectional view an arrowhead as according to this invention;

FIG. **62** is a cross-sectional view of a cutting blade of the arrowhead as illustrated in FIG. **61**;

FIG. **63** is a cross-sectional view of the arrowhead body of the arrowhead as illustrated in FIG. **61**;

FIG. **64** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **65** is a side view of an arrowhead tip as according to this invention;

FIG. **66** is a cross-sectional view and a side view of a cutting blade as according to this invention;

FIG. **67** is a partial section partial length side view of an arrowhead as according to this invention;

FIG. **68** is a cross-sectional view the arrowhead as illustrated in FIG. **64**;

FIG. **69** is a cross-sectional view of the arrowhead body of the arrowhead as illustrated in FIG. **64**;

FIGS. **70-75** are cross-sectional views of other arrowheads as according to this invention;

FIG. **76** is a partial sectioned side view of an arrowhead as according to this invention;

FIGS. **77&78** are exploded partial section partial length side views of an arrowhead as according to this invention;

FIG. **79** is a cross-sectional view of the arrowhead as illustrated in FIG. **76**;

FIG. **80** is a cross-sectional view of the arrowhead body of the arrowhead as illustrated in FIG. **76**;

FIGS. **81 & 82** are a cross-sectional view and a side view of a cutting blade as according to this invention;

FIGS. **82-85** are cross-sectional views of other arrowheads as according to this invention;

FIG. **86** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **87** is an exploded partial sectioned side view of the arrowhead as illustrated in FIG. **86**;

FIG. **88** is an exploded partial length side view of an arrowhead as according to this invention;

FIG. **89** is a side view of a cutting blade as according to this invention;

FIG. **90** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **91** is a top view of an arrowhead as according to this invention;

FIG. **92** is a cross-sectional view of the arrowhead tip of the arrowhead as illustrated in FIG. **91**;

FIG. **93** is a top view of an arrowhead as according to this invention;

FIG. **94** is a cross-sectional view of the arrowhead tip of the arrowhead as illustrated in FIG. **93**;

FIG. **95** is a cross-sectional view of an arrowhead tip as according to this invention;

FIG. **96** is a top view of an arrowhead as according to this invention;

FIG. **97** is a cross-sectional view of the arrowhead tip of the arrowhead as illustrated in FIG. **96**;

FIG. **98** is a top view of an arrowhead as according to this invention;

FIG. **99** is a cross-sectional view of the arrowhead tip of the arrowhead as illustrated in FIG. **98**;

FIGS. **100-102** are top views of arrowheads as according to this invention;

FIGS. **103-105** are cross-sectional views of arrowhead tips as according to this invention;

FIG. **106** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **107** is a side view of an arrowhead tip as according to this invention;

FIG. **108** is a side view of a cutting blade as according to this invention;

FIG. **109** is a side view of an arrowhead cutting blade and a set screw as according to this invention;

FIG. **110** is a cross-sectional view of an arrowhead body as according to this invention;

FIG. **111** is a cross-sectional view of an arrowhead as according to this invention;

FIG. **112** is a side view of a cutting blade as according to this invention;

FIG. **113** is a side view of an arrowhead tip as according to this invention;

FIG. **114** is a cross-sectional view of an arrowhead as according to this invention;

FIG. **115** is a side view of a cutting blade as according to this invention;

FIG. **116** is a partial sectioned side view of an arrowhead as according to this invention;

FIGS. **117-121** are side views of cutting blades as according to this invention;

FIG. **122** is a side view of a set screw as according to this invention;

FIG. **123** is a cross-sectional view of an arrowhead as according to this invention;

FIG. **124 & 125** are side views of cutting blades as according to this invention;

FIG. **126** is a cross-sectional view of an arrowhead as according to this invention;

FIG. **127 & 128** are side views of cutting blades as according to this invention;

FIG. **129** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **130** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **131** is a partial sectioned side view of an arrowhead as according to this invention;

FIGS. **132 & 133** are side views of cutting blades as according to this invention;

FIGS. **134 & 135** are side views of set screws as according to this invention ;

FIG. **136** is a side view of a cutting blade as according to this invention;

FIG. **137** is a top view of an annular ring as according to this invention;

FIG. **138** is a cross-sectional view of an arrowhead as according to this invention;

FIG. **139** is a side view of a cutting blade as according to this invention;

FIG. **140** is a cross-sectional view of an arrowhead as according to this invention;

FIG. **141** is a side view of a cutting blade as according to this invention;

FIGS. **142-149** are partial sectioned side views of arrowheads as according to this invention;

FIG. **150** is a cross-sectional view of the arrowhead as illustrated in FIG. **149**;

FIGS. **151-162** are cross-sectional views of arrowheads as according to this invention;

FIG. **163** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **164** is a cross-sectional view of the arrowhead as illustrated in FIG. **163**;

FIGS. **165-180** are cross-sectional views of arrowheads as according to this invention;

FIG. **181** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **182** is a cross-sectional view of the arrowhead as illustrated in FIG. **181**;

FIG. **183** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **184** is a cross-sectional view of the arrowhead as illustrated in FIG. **183**;

FIG. **185** is a partial sectioned side view of an arrowhead as according to this invention;

FIG. **186** is a cross-sectional view of the arrowhead as illustrated in FIG. **185**;

FIGS. **187-193** are cross-sectional views of arrowheads as according to this invention;

FIG. **194** is a partial sectioned side view of an arrowhead as according to this invention; and

FIG. **195** is a cross-sectional view of the arrowhead as illustrated in FIG. **194**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1-8** illustrate a blade-opening arrowhead **200** as according to one preferred embodiment of this invention. Arrowhead **200** has a forward leading end **1090**, a plurality of three pivotal cutting blades **900** and a plurality of three fixed cutting blades **300**. Each fixed cutting blade **300** has a cutting edge **400** that is substantially in coplanar alignment with a cutting edge **950** of a corresponding pivotal blade **900** when arrowhead **200** is in a penetrating configuration, as is illustrated in FIG. **1**. As is also illustrated in FIG. **1** each cutting edge **400** is not in collinear orientation or alignment with a corresponding cutting edge **950** that it is coplanar with. Each cutting edge **950** has a pair of grind bevels **952** such as is first ground on cutting blades in a strip grinding process as is well known to those skilled in the art. It is apparent that grind bevels **952** may have hone bevels as well, such as substantially convex hone bevels as is attainable with frustuconical grinding wheels. As also illustrated in FIG. **1** cutting edges **400** of blades **300** are located rearward of leading forward end **1090** of arrowhead **200**.

Arrowhead **200** has a removably attachable arrowhead tip **800** that has a plurality of three facets **850**, and a plurality of three facet boundary cutting edges **870** each of which is also substantially in coplanar alignment with both a corresponding cutting edge **400** and a corresponding cutting edge **950** when arrowhead **200** is in a penetrating configuration. Arrowhead tip **800** is preferably a hollow ground trocar tip or chisel type bone-splitting tip as is well known in the industry. It is apparent that facets **850** may be substantially convex or flat. Although arrowhead tip **800** is depicted as having a greatest cross-sectional diameter that is not wider than the cross-sectional diameter of an arrowhead body **600** where the rear end of tip **800** abuts thereagainst when the arrowhead is assembled, it is apparent that the arrowhead tips as according to this invention may have greatest cross-sectional diameters that are wider than the cross-sectional diameter of an accompanying arrowhead body at which the rear end of such a tip abuts thereagainst or adjoins therewith. Such wider arrowhead tip greatest cross-sectional diameters may be found in a barrel section of the arrowhead tip and/or in a facet region thereof. It is apparent that such wider diameter or cross-sectional arrowhead tips may be integral with their corresponding arrowhead bodies.

As is illustrated in FIG. **8** when arrowhead **200** is in an in-flight configuration a furthest section **1072** of each cutting edge **400** from a central longitudinal axis **1200** of arrowhead **200** is closer to central longitudinal axis **1200** than a furthest section **1074** of each pivotal blade **900**. This provides for an aerodynamically favorable arrowhead as is according to the desired results of this invention. Furthermore, as is illustrated in FIG. **1** when pivotal blades **900** are in a fully open position such that arrowhead **200** is in a penetrating configuration, cutting edges **400** are located forward of cutting edges **950** such that cutting edges **400** will slice or cut target material in front of blades **900** which greatly reduces the frictional drag that otherwise would of been generated between arrowhead **200** and the target material or the object being penetrated, as is according to the desired results envisioned by this invention.

It is apparent that arrowheads as according to this invention of a necessity do not have to have furthest sections **1072** or equivalents of penetration enhancing forward leading cutting edges such as cutting edges **400** located at a distance closer to the central longitudinal axis of their corresponding arrowhead bodies than furthest sections **1074** or equivalents of each pivotal blade or main cutting blade when in an in-flight configuration to provide arrowheads having favorable flight aerodynamics and enhanced penetration characteristics as according to the desired results of this invention.

As is also illustrated in FIG. **1** section **1072** of each cutting edge **400** is further from central longitudinal axis **1200** of arrowhead **200** than a widest section **1076** of arrowhead body **600** that is located rearward of cutting edges **400**. This provides an arrowhead that cuts target material in front of the main cutting blades at a cutting diameter that is wider than the arrowhead body's widest cross-sectional diameter, so as to immediately open a wide wound channel for the arrowhead body, main cutting blades and arrowshaft to effortlessly follow, as is within the scope of the desired results of this invention.

Arrowhead **200** has an arrowshaft contacting surface **1080** as is illustrated in FIG. **8** such that when arrowhead **200** or the other arrowheads as according to this invention are attached to an arrowshaft whether by screwing thereon or glueing or etc., arrowshaft contacting surface **1080** contacts the arrowshaft or equivalent such as an arrowshaft insert. As is clearly illustrated in FIGS. **1** & **8** the rearward most section **1072** of each cutting edge **400** is situated upon arrowhead **200** at

a location closer to forward leading end **1090** than to arrowshaft contacting surface **1080**. Each pivotal blade **900** has a wing **970** that extends therefrom in a direction outwardly from arrowhead body **600** when arrowhead **200** is in an in-flight or closed retracted configuration as is illustrated in FIG. **8**. Wings **970** serve to increase the moment-arm for levering blades **900** from their folded-up closed position when beginning to rotate towards an open position.

It is apparent that arrowhead **200** or other arrowheads as according to this invention could be shot from an archery bow when in an open position such as is depicted in FIG. **1** so as to simultaneously achieve both the favorable aerodynamic and enhanced penetration desired results as according to this invention. Such performance objectives are achievable with an arrowhead similar to arrowhead **200** since pivotal blades **900** have a relatively minor exposed surface area when in an open configuration, as compared to that of conventional fixed-blade arrowhead blades. Thus when shot in an open position such pivotal blade arrowheads as according to this invention would have accurate and favorable flight characteristics like unto other non blade-opening pivotal blade arrowheads, as is known to those skilled in the art, while also achieving improved penetration over prior art conventional arrowheads.

Although not specifically illustrated in this specification, it is apparent that the various elements, designs and functional objective results of the arrowheads as according to this invention and of those arrowheads incorporated herein by specific reference are applicable to blade-opening arrowheads whose blades rotate in a forward direction -toward the forward leading end of the arrowhead- when rotating to an open position or a penetrating configuration upon impact of a target or application of an opening force. For example, such arrowheads as that which have plunger shafts, wedging cams and/or other components that have movement in an axial or elongate direction relative to an accompanying arrowshaft, or other arrowhead components whether attached directly to a cutting blade or not, are within the scope of the arrowheads as according to this invention. As a specific example, a wedge cam with a tip end exposed from an accompanying arrowhead body when such an arrowhead is in a penetrating configuration could have a cutting blade or cutting edge such as cutting edge **400** thereon so as to cut target material in front of a main arrowhead cutting blade and to therefore achieve the increased penetration and reduced frictional drag desired results of this invention.

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FIGS. **1- 3 & 6** illustrate in detail how fixed-blades **300** are removably attached to arrowhead **200**. Arrowhead body **600** of arrowhead **200** has a blade slot **750** for each pivotal blade **900**, a blade slot **700** for each fixed-blade **300**, an internal leg cavity **686**, an internal threaded cylinder or bore **674** and a washer **670**. Each fixed-blade **300** has a pair of grind bevels **402-402** (which may also comprise hone bevels as is know to those skilled art), a pair of opposing substantially parallel side surfaces or faces **406**, a leg **404** and a forward locking end **408**. In addition to facets **850** arrowhead tip **800** has a shaft **830**, an undercut locking surface **843** and an undercut locking cavity **842**. Each fixed-blade **300** is placed in its corresponding slot **700** such that when arrowhead tip **800** is screwed into arrowhead body **600** locking ends **408** of blades **300** seat into undercut locking cavity **842** and abut against undercut locking surface **843** and against shaft **830** of arrowhead tip **800** which firmly attaches blades **300** to arrowhead **200**.

It is apparent that the method and/or manners of attaching or providing a friction reducing forward leading cutting edge or a penetration enhancing cutting edge such as a cutting edge **400** to or with the arrowheads of this invention is of relatively minor importance to the scope of this invention. As will become apparent from this specification and its parent patent application incorporated herein by specific reference there are many and various suitable manners to provide a cutting edge that is configured such upon its corresponding arrowhead body so as to cut target material in front of a main arrowhead cutting blade such as a pivotal blade of a blade-opening arrowhead so as to achieve the increased penetration and reduced frictional drag desired results of this invention. Therefore, it is apparent that any method or the like for providing an arrowhead with a cutting edge that achieves the objectives and desired results of this invention is within the scope of this invention.

As illustrated in FIG. **1** arrowhead **200** has an annular blade ring **1000** which hingedly or pivotally connects each blade **900** to arrowhead body **600**, an annular notch ring **1020** and an annular compression spring **1030**. Annular compression spring **1030** urges annular ring **1020** into a second notch of each blade **900** when arrowhead **200** is in an open or penetrating configuration such as FIG. **1** depicts. Whereas, as illustrated in FIG. **8** annular compression spring **1030** urges annular ring **1020** into a first notch of each blade **900** when arrowhead **200** is in an in-flight or retracted configuration so as to retain each blade **900** in such position until acted upon by an opening force.

The arrowheads according to this invention having pivotal blades may be blade-opening arrowheads which are commonly known in the industry as mechanical broadheads, or may be non blade-opening arrowheads. It is apparent that the method of selectively retaining a pivotal blade of a blade-opening arrowhead in a closed or in-flight retracted position is of relatively minor significance to this invention. For example, as illustrated in FIG. **8** each blade **900** is biasedly flexed or camed against a corresponding fixed-blade **300** when arrowhead **200** is in a closed or in-flight configuration. This flexing could be used at least in part to selectively hold or retain pivotal blades **900** or other pivotal blades in a retracted or closed in-flight position or configuration.

As is particularly illustrated in FIGS. **1 & 8** washer **670** has a blade stop abutting surface **680** which serves to limit the rotation of blades **900** when expanded to the open position or penetrating configuration so as to define the cutting diameter of the arrowhead. It is apparent that the arrowheads as according this invention may have varying types of blade stop structures such as washer **670** which serve to provide the functions of limiting the rotation of corresponding pivotal blades by abutting thereagainst, lessening the impact forces delivered to the hinge pin(s) and preventing undesirable damage to accompanying arrowshafts and/or other arrowhead structures. For example, the pivotal blades as according to this invention may abut against integrally attached or formed sections of corresponding arrowhead bodies, substantially flat blade stop washers or recessed blade stop washers like unto washer **670**. Preferably the blade stop washers or equivalents as according to this invention are hardened sufficiently such as by caborizing, case hardening or other heat treating or hardening techniques so as to not substantially be damaged by the impacting blades during target penetration, such as when the blades collide with heavy bone of a large game animal.

FIG. **7** illustrates a fixed-blade **302** which is similar to fixed-blade **300** except blade **302** has a curved section **410** that fits snugly with the curvature of slots **700**. As is illustrated in FIG. **5** an arrowhead tip **802** with a threaded female cavity **820** could be used in place of tip **800** by the addition of an arrowhead tip coupler **868**.

As is best illustrated in FIG. **2** slots **700** are narrower than slots **750** and a slot **700** and a corresponding adjacent slot **750** are both substantially radially aligned with central longitudinal axis **1200** of arrowhead **200**, and are in parallel alignment with each other, such that an elongate line

parallel to central longitudinal axis **1200** simultaneously intersects both a slot **700** and its corresponding paired or adjacent slot **750** as is according to the desired results of some of the preferred arrowhead embodiments of this invention. Each blade slot **750** of arrowhead **200** has a pair of partially bounding opposing sidewalls **753** that each extend to an exposed exterior corner **757** at the conjunction of sidewalls **753** with the exterior surface of arrowhead body **600** as is illustrated in FIGS. **1 & 2**. As according to this invention a blade slot generally includes its bounding sidewalls.

FIG. **9** illustrates an arrowhead **200b** which is similar to arrowhead **200** except that arrowhead **200b** has a plurality of slots **751** for pivotal blades **900** to be received therein which are non-radially aligned with respect to central longitudinal axis **1200** and a plurality of similarly non-radially aligned slots **702** for fixed-blades **300** to be received therein. It is apparent that there are various manners for the blade slots as according to this invention to be configured upon their corresponding arrowhead bodies such as to provide arrowheads that perform within the scope of this invention.

For example, FIGS. **10 & 11** illustrate an arrowhead **201** that is similar to arrowhead **200** except arrowhead **201** has a plurality of blade slots **706** for removably receiving a plurality of fixed-blades **304** that are each substantially the same thickness of a pivotal blade **900**. Each blade slot **706** is substantially a part of a corresponding slot **750** since slots **706 & 750** communicate with each other, wherein a slot **706** and a slot **750** could be fabricated from the same circular slitting saw by two-dimensional plunge slotting procedures.

FIGS. **12 & 13** illustrate an arrowhead **202** that is similar to arrowhead **200** except arrowhead **202** has a female cavity screw on arrowhead tip **802** as is clearly illustrated in FIG. **4**, a plurality of fixed-blade slots **704** and a plurality of hollow cylinders **676** (as is best seen in the cross-sectional view of the arrowhead body thereof in FIG. **13**) for receiving legs **404** of accompanying fixed-blades therein. It is apparent that the various structural variations that produce blades slots such as blade slots housing forward leading penetration enhancing fixed blades as according to this invention or their equivalents may be combined in various different manners one amongst another including in combinations that are not necessarily depicted in this specification so as to obtain the desired results of this invention.

FIGS. **14-16** illustrate an arrowhead **203** that is similar to arrowhead **200** except arrowhead

203 has a plurality of fixed-blade slots **708** that are contained or situated within corresponding adjoining slots **750** such that each slot **708** is substantially non-equidistantly displaced from opposing elongate sidewalls of its corresponding slot **750**. As is illustrated in FIG. **16** each slot **708** and corresponding slot **750** are parallely aligned with each other such that slots **750** are radially aligned with the central longitudinal axis of arrowhead **203** but slots **708** are non-radially aligned therewith.

Radial alignment in contrast to non-radial alignment generally refers to the geometric orientation or positioning of an element with respect to a radial line extending outward from a central longitudinal axis of a reference object such as an arrowhead body or an arrowhead. With reference to blade slots, a plane parallel to opposing sidewalls of a corresponding blade slot that is equidistantly displaced between such sidewalls such that the plane is substantially in coplanar alignment with the central longitudinal axis of an accompanying arrowhead generally constitutes a radially aligned blade slot, whereas such a plane that is not substantially in coplanar alignment with the central longitudinal axis of an accompanying arrowhead generally constitutes a non-radially aligned blade slot. It is apparent that such definition is allowed to fluctuate within the realm of attainable manufacturing tolerances so that the intent of the arrowhead design should generally dictate radial versus non-radial orientations thereof.

FIGS. **17-19** illustrate an arrowhead **204** that is similar to arrowhead **200** except arrowhead **204** has a plurality of fixed-blade slots **710** such that each fixed-blade slot **710** is situated at a distance spaced apart from its corresponding adjacent slot **750**. As is illustrated in FIG. **19** each slot **710** and corresponding adjacent slot **750** are parallely aligned with each other such that slots **750** are radially aligned with the central longitudinal axis of arrowhead **204** but slots **710** are non-radially aligned therewith.

FIGS. **20 & 21** illustrate an arrowhead **205** and an arrowhead **206** which are similar to arrowhead **200** except that both arrowheads **205** and **206** have fixed-blade slots that are spaced apart from corresponding adjacent main cutting blade slots **750** such that their fixed-blade slots are radially aligned with corresponding arrowhead central longitudinal axises and their fixed-blade slots are not in parallel alignment with corresponding adjacent slots **750**.

FIGS. **22-24** illustrate an arrowhead **207** which is similar to arrowhead **204** except that arrowhead **207** has a plurality of fixed-blades **306** attached to an arrowhead body **608** having an

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externally exposed annular recess **782** formed thereon for removably receiving an annular ring **1050** which aids in the securement of blades **306** to arrowhead body **608**. Externally exposed annular recess **782** comprises a lip **784** which aids in maintaining annular ring **1050** attached to arrowhead body **608** so as to perform its function. It is apparent that annular ring **1050** could be either compressed to a narrower diameter or expanded to a wider diameter when seated in recess **782** as compared to its non-attached or free diameter.

FIGS. **25-27** illustrate an arrowhead **208** which is similar to arrowhead **207** except that arrowhead **208** utilizes a plurality of partially threaded set screws **1004** that each screw into a through hole **786a** in an arrowhead body **610** which aids in the securement of blades **300** to arrowhead body **610**. As is illustrated in FIG. **27** it is apparent that a fully threaded set screw **1002** could be used in place of set screw **1004**.

FIGS. **28-30** illustrate an arrowhead **209** which has an arrowhead body **612**, a female arrowhead tip **802** and a plurality of fixed-blades **308** each having an aperture **450** sized so as to removable receive a set screw such as set screw **1004** therein. Arrowhead body **612** has a threaded through hole for receiving each set screw **1004** which attaches blades **308** to arrowhead **209** each within a blade slot **716**. As is illustrated in FIG. **31** from a fixed-blade **310** with a forward locking end **416** it is apparent that the forward locking ends of the fixed-blades as according to this invention may have any shape such that enables them to be secured to their corresponding arrowhead tips or arrowhead bodies or equivalents.

FIGS. **32-34** illustrate an arrowhead **210** which is similar to arrowhead **200** except that arrowhead **210** utilizes a plurality of partially threaded set screws **1010** for pivotally connecting a plurality of three pivotal blades **902** to an arrowhead body **614**, and a conventional rubber O-ring **1040** for selectively retaining blades **902** in an in-flight configuration until acted upon by an opening force. Blades **902** are of a length such that each cutting edge **950** thereof is displaced rearward of its corresponding adjacent fixed-blade **300** such that blades **902** and blades **300** do not biasly flex against each other when the arrowhead is in an in-flight configuration as is illustrated in FIG. **32**. Arrowhead body **614** has an arrowshaft contacting surface **1082** that is integral or substantially non-removably attached with arrowhead body **614** and a blade stop abutting surface **682** for each blade **902**. Blade stop abutting surfaces **682** are also integral with arrowhead body **614**.

It is apparent that the arrowhead tips of the arrowheads as according to this invention may be removable attachable from their corresponding arrowhead bodies such as having internal female threaded bores or externally protruding threaded male studs. It is apparent that the arrowhead tips of the arrowheads as according to this invention may be substantially non-removably attached to corresponding arrowhead bodies such as being frictionally press-fitted thereon, welded or glued on. It is also apparent that the arrowhead tips of the arrowheads as according to this invention may be substantially integrally formed with their corresponding arrowhead bodies, such as substantially being a machined or milled forward extending section of an accompanying arrowhead body that for example, is fabricated from a single piece of metal stock.

FIGS. **35-37** illustrate an arrowhead **211** which has an arrowhead tip **804** integrally formed with an arrowhead body **616**. Arrowhead **211** has a plurality of three fixed-blade slots **720** formed thereon, a pair of fixed-blades **312** which are substantially non-removably attached thereto by welding or other similar result producing techniques, and a fixed-blade **318** attached thereto by a pair of set screws **1006** removably received through a pair of apertures **452** when threaded into a pair of through holes **786b** formed in arrowhead **211**. FIGS. **38 & 39** illustrate fixed-blades **314 & 316** which are at least in part similar to blades **312 & 318** and as is also their methods of attachment to corresponding arrowhead bodies, except that blades **314 & 316** have forward locking protrusions **418** projecting forwardly therefrom. It is apparent that a void such as a milled out hollow cylinder could be formed communicatingly with each slot **720** so as to matingly receive forward locking protrusions **418** when blades **314 & 316** or other similar blade designs having forward locking protrusions or equivalents as according to this invention are attached with accompanying arrowhead bodies or arrowhead tips, particularly with arrowheads having arrowhead tips substantially integrally formed with their corresponding arrowhead bodies or other arrowhead structure such as has arrowhead **211**.

FIGS. **40-44** illustrate an arrowhead **212** and an arrowhead **213** both of which utilize a plurality of pivotal blades **320** to provide friction reducing forward leading cutting edges **400** as according to the penetration enhancement desired results of this invention. Each blade **320** is pivotally connected to corresponding arrowhead bodies by a hinge pin **1008** within corresponding slots (a plurality of slots **722** of arrowhead **212** and a plurality of slots **724** of arrowhead **213**) as has

been illustrated herein with forgoing preferred embodiments.

FIGS. **45-47** illustrate an arrowhead **214** which is similar to arrowhead **212** except that arrowhead **214** utilizes a plurality of pivotal blades **322** to provide friction reducing forward leading cutting edges **400** for penetration enhancement. As is illustrated in FIG. **45** by aid of a line **1070** which is parallel to the central longitudinal axis of arrowhead **214**, when arrowhead **214** is in an in-flight configuration furthest section **1072** of each cutting edge **400** from the central longitudinal axis of arrowhead **214** is closer to the central longitudinal axis of arrowhead **214** than furthest section **1074** of each pivotal blade **902**. This provides for an aerodynamically favorable and penetration enhancing arrowhead as is according to this invention. FIG. **47** illustrates blades **902** rotated to their fully open position and abutting against integral blade stop surfaces **682**.

FIGS. **48-54** illustrate an arrowhead **215** which is similar to arrowhead **210** except that arrowhead **215** utilizes a plurality of fixed-blades **324** that each have a bent portion or a flange **470**, an arrowhead tip **810**, and an arrowhead body **624** with a plurality of three fixed-blade slots **726** each having a thickness or a width of at least twice the thickness of a blade **324**. Arrowhead tip **810** has an undercut locking cavity **844** and an undercut locking surface **845**. Locking surface **845** engages or abuts against a square stepped forward locking end **420** of each blade **324** when the arrowhead is assembled so as to aid in the securement of blades **324** to arrowhead body **624**. As is clearly illustrated in FIG. **49** bent portion **470** of each blade **324** is housed within a neighboring slot **726** that is spaced apart from the slot **726** the rest of the particular blade **324** is housed within. As is illustrated in FIGS. **51 & 54** each blade **324** has a pair of opposing exterior surfaces or side faces which are depicted as **480, 490 & 480, 490** for each blade **324** respectively, and which are distinct from a blade edge **401** extending peripherally thereabout. Peripheral blade edge **401** includes grind bevels **402-402** and cutting edge **400**. Each exterior side face **480** is substantially flat or planar as is each exterior side face **490**, however since flange **470** is bent, exterior side faces **490** are not in coplanar alignment with exterior sides faces **480** but are offset therefrom by substantially 120 degrees. Bent portions **470** by being housed in neighboring spaced apart slots **726** aid in the securement of blades **324** to arrowhead body **624** when the arrowhead is assembled.

FIGS. **55-61** illustrate arrowheads **216-218** which are similar to arrowhead **215** except that arrowheads **216-218** have fixed-blades with angular offsets between exterior side faces **480 & 490**

that differ from the angular offset between exterior side faces **480 & 490** of blades **324**. Arrowhead **217** has a plurality of four blades **328** each with an angular offset between exterior side faces **480 & 490** of substantially 90 degrees, and arrowhead **218** has a plurality of five blades **330** each with an angular offset between exterior side faces **480 & 490** of substantially 72 degrees. Arrowhead **216** has a plurality of two blades **326** each with an angular offset between exterior side faces **480 & 490** such that a face **490** of each blade **326** abuts against each other when aiding in the securement of blades **326** to the arrowhead.

FIGS. **64-68** illustrate an arrowhead **219** which is similar to arrowhead **215** except that arrowhead **219** has a plurality of hollow cylinders **678** each communicating with a blade slot **728** that together house or secure a plurality of fixed-blades **332** to an arrowhead body **626**. Arrowhead body **626** has a male stud **788b** that threadably receives a female tip **812** thereon. Bent flange **470** of each blade **332** is received in a corresponding hollow cylinder **678** as is illustrated in FIG. **67**. As is illustrated in FIG. **68** a central elongate axis **1070** of each cylinder **678** is spaced apart from a central longitudinal axis **1060** of arrowhead body **626** so as to not be collinear therewith.

FIGS. **69 & 70** illustrate arrowheads **220 & 221** which are similar to arrowhead **219** except arrowheads **220 & 221** differ in number of blades **332** and corresponding hollow cylinders **678**.

FIGS. **71 & 72** illustrate an arrowhead **224** which is similar to arrowhead **219** except that arrowhead **224** has a plurality of narrower diameter hollow cylinders **684** and a plurality of corresponding different shaped blades **334** to snugly fit therewith.

FIGS. **73-75** illustrate arrowheads **222 & 223** which are similar to arrowhead **219** except arrowheads **222 & 223** utilize a male threaded stud arrowhead tip **814**.

FIGS. **76-82** illustrate an arrowhead **225** which is similar to arrowhead **215** except that arrowhead **225** has a centrally located hollow cylinder **687** that communicates with a plurality of blade slots **730** that together secure a plurality of fixed blades **336** to an arrowhead body **628**. Hollow cylinder **687** is bound at least in part by an internal wall surface **688** as is illustrated in FIG. **80**. As is illustrated in FIG. **79** shaft **830** of arrowhead tip **814** is disposed in cylinder **687** when the arrowhead is assembled so that bent portion **470** of each blade **336** is located between shaft **830** and internal wall **688** which aids in the attachment or securement of blades **336** to arrowhead body **628**.

FIGS. **83-85** illustrate arrowheads **226-228** which are similar to arrowhead **225** except

arrowheads **226-228** differ in the number of blades **336** contained therewith.

FIGS. **86 & 87** illustrate an arrowhead **229** having an upper arrowhead body piece **630b** and a lower body piece **630a** that threadably attach to each other in such a manner so as to secure a plurality of blades **338** into a plurality of corresponding blade slots **730** and to provide an arrowhead that achieves the desired results as according to this invention.

FIG. **88** illustrates an arrowhead **230** which is similar to arrowhead **229** except that arrowhead **230** removably receives male tip **814** whereas arrowhead **229** utilizes female tip **810** and arrowhead **230** utilizes a plurality of fixed-blades **340** each having a beveled locking end **405** that is seated in-line with a locking bevel **734** of an upper arrowhead body piece **632b** thereof when assembled into an arrowhead. FIG. **89** illustrates a fixed-blade **342** which is similar to fixed-blade **340** except that fixed-blade **342** has a bent flange **470** for additional aid in securement of blades **342** to an accompanying arrowhead as has been set forth herein.

FIG. **90** illustrates an arrowhead **231** having a removably attachable blade stop washer **673** and an arrowhead body **634** with a plurality of inclined slots **758** and a plurality of inclined slots **736** to receive a plurality of blades **902** and a plurality of blades **300** respectively. Blades **300** and **902** are inclined relative to central longitudinal axis **1200** of arrowhead **231** in such a manner that a cutting edge **400** and a cutting edge **950** of corresponding paired or adjacent blades **902** and **300** are in substantial coplanar alignment with each other and cause arrowhead **231** to spin when penetrating a target. As illustrated in FIG. **90** blades **902** abut against a slightly beveled abutting surface **683** of a substantially flat blade stop washer **673**. It is apparent that arrowheads having spin inducing capacities as according to this invention such as when penetrating a substance or when in-flight, such as arrowhead **231**, may have any type of blade stop abutting surface or blade stop washer or equivalent as has been set forth herein, or as in known to those skilled in the art.

FIGS. **91 & 92** illustrate an arrowhead **232** which is similar to arrowhead **231** except that arrowhead **232** has facet boundaries **870** substantially in-line with cutting edges **400** and **950**. Arrowhead **232** like arrowhead **231** when penetrating a target spins counter clockwise when viewed from above, or right handedly when viewed from the side. FIG. **92** in particular illustrates that a facet exterior surface **850b** on one side of each facet boundary **870** has substantially the same slope at distances equidistantly displaced from facet boundary **870** as does a facet exterior surface **850a**

on an opposing side of facet boundary **870**.

FIGS. **93-105** illustrate arrowheads **233-238** which are similar to arrowhead **232** in that arrowheads **233-238** each have inclined blades to induce spinning upon target penetration but differ in varying manners from arrowhead **232** as will be set forth herebelow.

Arrowhead **233** as illustrated in FIG. **93** has a plurality of non-linear or curved facet boundaries **874** that curve in a clockwise direction when viewed from above. The arrowhead tip of arrowhead **233** has a facet exterior surface **854b** on one side of each facet boundary **874** that has a substantially different slope than the slope of a facet exterior surface **854a** on an opposing side of each facet boundary **874** as is illustrated in FIG. **94**. Particularly, as illustrated in FIG. **94** facet exterior surface **854b** has a more dished out or concave slope than does facet exterior surface **854a**. It is apparent that facet exterior surfaces **854a & 854b** or other similar facet exterior surfaces of this invention as illustrated in FIG. **94** could be reversed so as to be such as is illustrated in FIG. **95**. It is apparent that facet exterior surfaces **854a & 854b** or other similar facets of this invention that have differing slopes on opposing sides of corresponding facet boundaries could have convex facets, or at least a section thereof that is substantially convex.

When arrowhead **233** is penetrating a target such as a game animal facet exterior surfaces **854a & 854b** create differing resistive forces due to their differing slopes or shapes which induces a net rotational force in a particular direction upon arrowhead **233** so as to cause it to turn or spin about its central longitudinal axis. Such rotational force can induce an increased spinning effect upon the arrowhead if aligned in the same direction as the spinning force produced from the inclined blades, or it can produce a braking effect if directed in opposition to the spin induced force of the inclined blades. Blades **902 & 300** induce clockwise spinning upon arrowhead **233** when viewed from above or left handed spinning when viewed from the side. It is apparent that the various spin or braking inducing designs of the various embodiments of this invention may be combined with each other and with the various different arrowheads as according to this invention, as well as with other such result producing arrowheads know to those skilled in the art, including in manners that have not been suggested herein, such as with embodiments taught in my U. S. Patent ~~application Serial No. 08/858 096 filed May 17, 1997~~ 6,171,206, which is incorporated herein by specific reference. 2-19-01

Arrowhead **234** as illustrated in FIG. **96** has a plurality of non-linear or curved facet

boundaries **876** that curve in a counter clockwise direction when viewed from above, and the facet exterior surfaces of a plurality of facets **858** thereof have substantially the same slope on opposing sides of each facet boundary **876**. It is also apparent that curved facet boundaries such as facet boundaries **874 & 876** can also induce or enhance spinning or braking in and of themselves by providing a drill-bit effect when penetrating target material.

Arrowhead **235** as illustrated in FIG. **98** has a plurality of linear or non-curved facet boundaries **890** such that a facet exterior surface **860b** on one side of each facet boundary **890** has a substantially different slope than the slope of a facet exterior surface **860a** on an opposing side of facet boundary **890** as is illustrated in FIG. **99**. The term linear as used herein refers to being straight, such as a straight line.

Arrowhead **236** as illustrated in FIG. **100** has a plurality of three facets **862**, and a plurality of non-radially aligned linear facet boundaries **892** that terminate in a forward leading end **1092** thereof. It is apparent that forward end **1092** may have a variety of different shapes including flat, concave, convex, pointed or such so as to be sharpened for cutting, chiseling or wedging. Blades **902** of arrowhead **236** are substantially non-radially aligned with the central longitudinal axis of arrowhead **236** which can enhance either the spinning or braking effects thereof depending on the directions the other spin inducing forces are directed thereon. Arrowhead tips as according to this invention having non-radially aligned facet boundaries, which may also comprise a cutting edge, will cause a spin or rotational force to be exerted upon corresponding arrowheads in such a similar manner as do non-radially aligned opened cutting blades.

Arrowhead **237** as illustrated in FIG. **101** has a plurality of three facets **864**, and a plurality of non-radially aligned linear facet boundaries **894** that connect to a forward leading end **1094** of the arrowhead by a plurality of radially aligned ridges **895**. It is apparent that ridges **895** may comprise, but not be limited to, facet boundaries as according to this invention. Blades **902** of arrowhead **237** are also substantially non-radially aligned with the central longitudinal axis of the arrowhead.

Arrowhead **238** as illustrated in FIG. **102** has a plurality of three facets **866**, and a plurality of non-radially aligned curved facet boundaries **896** that connect to a forward leading end **1096** thereof. Blades **902** of arrowhead **237** are also substantially non-radially aligned with the central longitudinal axis of the arrowhead. It is apparent that facets **862, 864 & 866** of arrowheads **236-238**

may have any sloped exterior facet shape, such as is illustrated in FIGS. **103-105** or other variations thereof.

FIGS. **106-108** illustrate an arrowhead **239** which has a plurality of fixed-blades **344** removably attached in a plurality of blade slots **738**. It is apparent that the penetration enhancing forward leading cutting edges or edge such as cutting edges **400** of blades **344** as according to this invention situated at least in part forward of a main cutting blade when a corresponding arrowhead is in a penetrating configuration may extend for any axial or elongate length upon corresponding arrowhead bodies.

FIGS. **109-115** illustrate other arrowheads as according to this invention which have fixed-blades of similar lengths as blades **344** of arrowhead **239**.

FIG. **109** illustrates that it is apparent that a blade **346** with an aperture can be attached to an arrowhead similar to arrowhead **209** as illustrated in FIG. **28**.

FIG. **110** illustrates that it is apparent that a blade of similar length as blade **344** can be attached with an arrowhead similar to arrowhead **219** as illustrated in FIGS. **64-68**.

FIGS. **111-113** illustrate that a blade **348** having a bent portion **470** can be attached with an arrowhead **240** which is similar to arrowhead **225** as illustrated in FIGS. **76-82**. Arrowhead **240** has an arrowhead tip **816** that has a substantially longer shaft **832** than shaft **830** of arrowhead tip **814** which is received in an accompanying substantially elongate longer cylinder or bore having at least an internal section thereof threaded.

It is apparent that the internal cylinders or bores of arrowheads as according to this invention, including ones that are substantially centrally oriented about an accompanying arrowhead central longitudinal arrowhead axis, may extend for any elongate length within their corresponding arrowhead bodies, including to a distance substantially near an accompanying arrowshaft contacting surface.

FIGS. **114 & 115** illustrate that a blade **350** having a bent portion **470** can be attached with an arrowhead **241** which is similar to arrowhead **215** as illustrated in FIGS. **48-52**.

FIGS. **116 & 117** illustrate an arrowhead **242** which has an arrowhead body **640** and a plurality of fixed-blades **352** removably attached in a plurality of blade slots **740**. Each pivotal blade **902** is pivotally connected within a blade slot **760** which has a forward wider section **760a** and

a rearward narrower section **760b**. Each rearward slot section **760b** is preferably substantially not less in width than the thickness of a blade **902** so as to hold each blade **902** relatively snugly therein and to therefore prevent any undesired blade wobble upon target penetration. Each forward slot section **760a** is preferably substantially of a width wide enough so as to allow each blade **902** to be folded into a retracted or closed in-flight position adjacent arrowhead body **640** such that arrowhead **242** maintains an aerodynamically favorable in-flight profile.

FIGS. **118 & 119** illustrate a blade **354** and a blade **356** that each have a leg **404** disposed thereon at a location substantially forward of their rear end sections. Cutting edge **400** of blade **356** has a forward section **400a** and a rearward section **400b**, which do not have at least a linear section thereof collinear with one another. Arrowhead blades **354 & 356** could be attached to the arrowhead body of arrowhead **239** as illustrated in FIG. **106** which would produce arrowheads having friction reducing or penetration enhancing forward leading cutting edges similar to that which arrowhead **242** sports.

FIGS. **120-122** illustrate that it is apparent that substantially elongate blades such as a blade **358** and a blade **360** with set screw receiving apertures can be attached to an arrowhead in a similar manner as blades **308** are attached to arrowhead **209** as illustrated in FIG. **28**.

FIGS. **123-128** illustrate other arrowheads as according to this invention which have fixed-blades of a similar length as blades **352** of arrowhead **242**.

FIGS. **123-125** illustrate that a blade **362** or a blade **364** each with a bent portion **470** can be attached to an arrowhead **243** or other similar arrowheads which are similar to arrowhead **240** as illustrated in FIGS. **111-113**. FIGS. **126-128** illustrate that a blade **366** or a blade **368** each with a bent portion **470** can be attached with an arrowhead **244** or other similar arrowheads which are similar to arrowhead **241** as illustrated in FIGS. **114 & 115**.

It is apparent that the friction reducing forward leading cutting edges or edge for enhanced penetration such as a cutting edge **400** as according to this invention situated at least in part forward of a main cutting blade when a corresponding arrowhead is in a penetrating configuration may project outward from the exterior surface of a corresponding arrowhead body a very small distance while serving to provide the penetration enhancement desired results of this invention.

FIG. **129** illustrates an arrowhead **245** which is similar to arrowhead **242** as illustrated in FIG.

116 except that arrowhead **245** utilizes a plurality of fixed-blades **357** which are at least in part similar to blade **356** as illustrated in FIG. **119**.

FIG. **130** illustrates an arrowhead **246** which is similar to arrowhead **245** except that arrowhead **246** utilizes a plurality of fixed-blades **370** which extend in axial or elongate length upon the arrowhead body thereof substantially less than that which blades **357** do. Arrowhead **246** has a plurality of slots **762** for housing the pivotal blades thereof, such that each slot **762** has a wider forward section **762a** and a narrower rearward section **762b**.

FIGS. **131** & **132** illustrate an arrowhead **247** which has an arrowhead body **646** and a plurality of fixed-blades **372** each with a hinge pin receiving aperture **460** and a forward locking end **416**. Arrowhead body **646** has a plurality of blade slots **746** and a plurality of blade slots **764** for receiving blades **372** and **902** respectively therein. Each cutting edge **400** of blades **372** is not in coplanar alignment with the cutting edge **950** of its corresponding paired adjacent pivotal blade **902**. Each blade **902** has a hinge pin receiving aperture **906** for receiving a hinge pin such as partially threaded set screw **1010**. Set screws **1010** pass through apertures **906** and **460** when threaded into arrowhead body **646** so as to attach or secure the rear end of each blade **372** to arrowhead body **646** as well as to pivotally connect blades **902** to arrowhead body **646**.

It is apparent that the penetration enhancement forward leading cutting edges or edge such as a cutting edge **400** as according to this invention situated at least in part forward of a main cutting blade when a corresponding arrowhead is in a penetrating configuration may extend substantially rearward to approximately near the forward most terminus or section of the cutting edge of a main arrowhead cutting blade, such as near to a cutting edge **950** of a pivotal blade.

FIGS. **133-137** illustrate a fixed-blade **374** and a fixed-blade **376**. Fixed-blade **374** has a set screw receiving aperture **458** in addition to aperture **460** for aiding in the attachment of blade **374** to a corresponding arrowhead body. Fixed-blade **376** has an aperture **462** in addition to aperture **460** for aiding in the attachment of blade **376** to a corresponding arrowhead body. FIG. **137** illustrates that an annular ring **1014** could be extended through aperture **462** of blade **376** when blade **376** is attached to an arrowhead.

It is apparent that cutting blades such as fixed-blade **372** or other substantially elongate similar function providing blades may be housed in blades slots that are spaced apart a distance away

from the blade slots of a corresponding arrowhead which house the main arrowhead cutting blades.

FIGS. **138-141** illustrate an arrowhead **248** and an arrowhead **249** which are similar to arrowheads heretofore disclosed, except arrowheads **248 & 249** utilize blades having hinge pin apertures **460** such as a blade **378** or a blade **380**.

FIG. **142** illustrates an arrowhead **250** which is similar to arrowhead **247** except that arrowhead **250** has a plurality of slots **766** for housing main cutting pivotal blades **902** and forward leading penetration enhancing cutting blades **372** therein. Therefore, arrowhead **250** only utilizes one blade slot **766** for housing each corresponding pair of blades **372 & 902**.

FIG. **143** illustrates an arrowhead **251** which is similar to arrowhead **250** except that arrowhead **251** has an arrowhead body **650** that has a constant sloped taper from the rear end of its arrowhead tip rearward to the widest section **1076** of arrowhead body **650**.

FIG. **144** illustrates an arrowhead **252** which is similar to arrowhead **247** of FIG. **131** except arrowhead **252** has a plurality of fixed-blades **384** that each are similar at least in part to blades **356** and **357** as previously disclosed.

FIG. **145** illustrates an arrowhead **253** which is similar to arrowhead **246** of FIG. **130** except arrowhead **253** has a plurality of blade slots **752** that each have a substantially uniform width for their entire axial or elongate length.

FIGS. **146 & 147** illustrate an arrowhead **254** which has a plurality of fixed-blades **386** housed within a plurality of blade slots **740** and an annular rubber O-ring **1042** for blade retention seated within an externally exposed annular recess **690**. As is clearly illustrated in FIG. **146** when arrowhead **254** is in an in-flight configuration the widest section **1072** of each cutting edge **400** is situated closer to the central longitudinal axis of the arrowhead than the widest section **1074** of each pivotal blade **902**.

FIG. **148** illustrates an arrowhead **255** which is similar to arrowhead **254** except that arrowhead **255** has a plurality of vented fixed-blades **388** each with a vent or cut-out section **430** and a plurality of pivotal blades **908** each having a notch **960** formed therein for receiving a conventional rubber O-ring which selectively retains or holds blades **908** in an in-flight configuration.

FIGS. **149 & 150** illustrate an arrowhead **256** with an arrowhead body **652** that has a plurality of integral cutting protrusions **550** each with a cutting edge **500** formed thereon. Each

integral cutting protrusion **550** is integrally fabricated or formed upon its arrowhead body **652** at least in part during a manufacturing process or processes such as grinding and/or impact swaging and/or milling etc. Each integral cutting protrusion **550** as is clearly illustrated in FIG. **150** has a pair of primary bevels **510** such as could substantially be, but not limited to, grind bevels disposed on either side thereof and a pair of side faces **520**. As is illustrated in FIG. **149** each cutting edge **500** is substantially in coplanar alignment with a cutting edge **950** of a corresponding pivotal blade.

As referenced in a plane perpendicular to the central longitudinal axis of arrowhead **256** the location upon each integral cutting protrusion **550** where the exterior surface of arrowhead body **652** (and therefore the external surface of each integral cutting protrusion **550**) changes slope either marks the boundary or junction of a primary bevel **510** with a side face **520**, or the boundary of a side face **520** with the junction of the arrowhead body **652** that is not comprised of an integral cutting protrusion **550**, or the cutting edge boundary **500** with opposing primary bevels **510** on either side thereof. As is clearly illustrated in FIG. **150** at least a section of the exterior surface of arrowhead body **652** that is not comprised of an integral cutting protrusion **550** extends between each integral cutting protrusion **550**.

It is apparent that integral cutting protrusions as according to this invention could consist essentially of only one side face **520** and one primary bevel **510** in addition to a cutting edge **500**, or that integral cutting protrusions as according to this invention could consist essentially of only two side faces **520** in addition to a cutting edge **500**, or that integral cutting protrusions as according to this invention could be comprised of other combinations of the various components of the integral cutting protrusions as according to this invention as disclosed within this specification.

Cutting edges **500** of the integral cutting protrusions as according to this invention serve to provide substantially the same function as cutting edges **400** as has been taught herein, in that cutting edges **500** act as forward leading cutting edges which are situated at least in part forward of a main cutting blade when a corresponding arrowhead is in a penetrating configuration so as to provide aerodynamically favorable arrowheads that enhance penetration by reducing the frictional drag that otherwise would of been generated between an arrowhead and target material by cutting such target material in front of the main cutting blade(s) during penetration.

FIGS. **151-162** illustrate arrowheads **257-268** which disclose a variety of different arrowhead

bodies and differing integral cutting protrusion examples as according to this invention. Such arrowheads are only considered examples of integral cutting protrusion as according to this invention and are not intended to be an all inclusive exhaustive collection thereof. Although the cross-sectional views of arrowheads **257-268** are taken substantially in a plane perpendicular to the central longitudinal axises of corresponding arrowheads so as to not intersect corresponding blades slots of the arrowheads, it is apparent that such cross-sectional views could also intersect corresponding blade slots and thus illustrate yet other arrowheads as according to this invention.

It is apparent that the arrowhead bodies of the arrowheads as according to this invention may be comprised of sharpenable materials such as composites or other organic polymers, metals particularly steels such as carbon steels, high carbon steels, various stainless steels and/or chrome-moly steels, carbides or other metals such as the various aluminum, titanium and vanadium alloys. It is apparent that the arrowhead bodies as according to this invention may be hardened in heat treating processes and that the integral cutting protrusions as according to this invention may be heat treated and/or hardened so as to retain an optimally desirable cutting edge as is according to the desired results of this invention. It is yet further apparent that arrowhead bodies as according to this invention being fabricated from composite or other moldable polymeric type materials including those combinable with matrix reinforcing elements may have cutting blades molded with such arrowhead bodies or arrowheads as is according to this invention.

It is within the desired results of this invention to provide a cutting edge located forward of a main cutting blade when an accompanying arrowhead is in a penetrating configuration that is as sharp as a virgin ground, honed and stropped razor edge. However, it is apparent that obtaining such a fine or razor sharp cutting edge as according to this invention is not of necessity a requirement for the arrowheads as according to this invention. For example, an edge or equivalent that cuts regardless of its sharpness located forward of a main cutting blade, when an accompanying arrowhead is in a penetrating configuration, that enhances penetration and/or reduces frictional drag in such a manner so that the arrowhead performs better in such desired objective traits than it would of otherwise performed without the forwardly located cutting edge(s) as according to this invention will meet the desired results of this invention.

Referring again to FIGS. **151-162** and arrowheads **257-268**, FIG. **152** illustrates arrowhead

258 having a plurality of integral cutting protrusions **552** that each have a pair of primary bevels **510** and a cutting edge **500**.

FIG. **153** illustrates an arrowhead **259** having a plurality of integral cutting protrusions **554** that each have a pair of primary bevels **510**, a pair of side faces **520**, a pair of secondary bevels **530** which could be identified as but not limited to hone bevels, and a cutting edge **500**. Side faces **520** of each integral cutting protrusion **554** are substantially parallel to each other.

For the integral cutting protrusions as according to this invention having a pair of hone bevels **530** or secondary bevels or only one hone bevel **530** in addition to a primary bevel **510** and/or a side face **520** or equivalents it is apparent that a change in slope of the exterior surface of the corresponding arrowhead body will also mark the junction or boundary of a hone bevel **530** with an adjoining different sloped exterior surface component of the integral cutting protrusion or other arrowhead structure.

FIG. **155** illustrates an arrowhead **260** having a plurality of integral cutting protrusions **556** that each have a pair of primary bevels **510**, a pair of side faces **520** and a cutting edge **500**. Side faces **520** of each integral cutting protrusion **556** are substantially not parallel to each other.

Arrowhead **261** as illustrated in FIG. **156** has a plurality of integral cutting protrusions **558** which are similar to integral cutting protrusions **552**. Arrowhead **265** as illustrated in FIG. **158** has a plurality of integral cutting protrusions **564** which are substantially the exposed corners of the conjunction of adjoining convex portions of the arrowhead body. Arrowhead **266** as illustrated in FIG. **161** has a plurality of integral cutting protrusions **560**. And arrowhead **267** as illustrated in FIG. **159** has a plurality of integral cutting protrusions **562**. It is apparent that an arrowhead tip as according to this invention could have a cross-section depicting a plurality of three convex facets such as is illustrated in FIG. **158**.

FIGS. **163 & 164** illustrate an arrowhead **269** having a plurality of integral cutting protrusions **566** that each have a pair of primary bevels **510**, a pair of side faces **520**, and a cutting edge **500** thereon. As is illustrated by line **1070** which is parallel to the central longitudinal axis of arrowhead **269**, the widest section **1072** of each integral cutting protrusion cutting edge **500** is further from the central longitudinal axis of the arrowhead than is the widest section **1076** of the arrowhead body that is located rearward of cutting protrusions **566**.

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FIGS. **165-180** illustrate cross-sectional views of arrowheads **270-285** and disclose a variety of different arrowhead bodies and different integral cutting protrusion examples as according to this invention. Arrowheads **270-285** all have non-radially aligned main cutting blade slots **779** as is clearly identified in FIG. **165**. Although slots **779** are shown in dotted lines which illustrates that the cross-sections are taken perpendicularly substantially so as to not intersects blade slots **779** of arrowheads **270-285** it is apparent that the cross-sectional views as illustrated in FIGS. **165-180** could be illustrative of arrowhead perpendicular sections having slots such as slots **779** disposed explicitly in such cross-sections or other slot configurations as taught herein or as known in the art, and thus FIGS. **165-180** could also illustrate other arrowheads as according to this invention.

FIG. **169** illustrates an arrowhead **274** which has a plurality of integral cutting protrusions **568** that each have a pair of primary bevels **510**, a pair of side faces **520** and a cutting edge **500**. Arrowhead **274** has a plurality of non-cutting surface sections **666** and a plurality of three flats **664** each containing a plurality of integral cutting protrusions **568** thereon. A straight line **1078** positioned so as to lay against but not intersect the exterior surfaces of two non-cutting surfaces **666** of arrowhead **274** does not substantially have any portion of an integral cutting protrusion **568** extending or projecting outwardly therebeyond on a side of line **1078** opposite the side thereof that the central longitudinal axis of arrowhead **274** is located on.

FIG. **172** illustrates an arrowhead **277** which is similar to arrowhead **274** except that arrowhead **277** has a plurality of integral cutting protrusions **570** that each have only a pair of primary bevels **510** and a cutting edge **500**. At least a section of the exterior surface of the arrowhead body of arrowhead **277** that is not comprised of an integral cutting protrusion **570** extends between each integral cutting protrusion **570**.

It is apparent that arrowheads as according to this invention which are similar to arrowhead **274** or arrowhead **277** could exist wherein in place of flats **664** an arrowhead could have a convexity or a concavity or another shaped exterior surface equivalent such that a non-linear or non-straight line that performs the function of line **1078**, which has the exact slope or slopes or shape as the non-flat other shaped exterior surface could be used to describe or teach such other arrowheads as line **1078** does for arrowheads disclosed herein.

FIGS. **181 & 182** illustrate an arrowhead **286** having a plurality of integral cutting

protrusions **572** that are inclined at an angle relative to the central longitudinal axis of arrowhead **286** so as to induce spinning on the arrowhead when penetrating a target.

FIGS. **183 & 184** illustrate an arrowhead **287** having a plurality of integral cutting protrusions **574**, a forward leading end **1098** and an integral arrowhead tip **818** having a plurality of facet boundaries **871** each with a cutting edge formed thereon. It is apparent that arrowhead tip **818** may have convex facets or flat facets or concave facets.

FIGS. **185 & 186** illustrate an arrowhead **288** having a plurality of integral cutting protrusions **576** that extend elongately rearward near to the forward most section or terminus of cutting edges **950** when arrowhead **288** is in a penetrating configuration. Each integral cutting protrusion **576** has a forward cutting edge section **500a** and a rearward cutting edge section **500b**. As is illustrated in FIG. **186** integral cutting protrusions **576** are non-radially aligned with the central longitudinal axis of the arrowhead.

FIGS. **187-193** illustrate cross-sectional views of arrowheads **289-295** and disclose a variety of different arrowhead bodies and different integral cutting protrusion examples as according to this invention. Arrowheads **289-295** each have a plurality of integral cutting protrusions that are radially aligned with the central longitudinal axises of their corresponding arrowhead bodies. Arrowhead **290** as illustrated in FIG. **188** has non-radially aligned main cutting blade slots **776a** which cause corresponding main cutting blades when in a penetrating configuration to produce a right handed spinning force on arrowhead **290**. Arrowhead **295** as illustrated in FIG. **193** has non-radially aligned main cutting blade slots **776b** which cause corresponding main cutting blades when in a penetrating configuration to produce a left handed spinning force on arrowhead **295**.

FIGS. **194 & 195** illustrate an arrowhead **296** that has an arrowhead body **662** and a plurality of integral cutting protrusions **582** that extend elongately rearward near to the forward most section or terminus of cutting edges **950**. Arrowhead body **662** has a constant sloped taper from the rear end of its arrowhead tip rearward to the widest section **1076** thereof. This is in contrast to arrowhead **288** as illustrated in FIG. **185** which does not have such constant slope tapered integral cutting protrusions **576**.

The arrowheads as according to this invention overcome deficiencies inherent in prior art arrowheads by providing arrowheads that enhance penetration and reduce the frictional drag that

otherwise would of been generated between an arrowhead and target material by cutting such target material in front of the main cutting blades during target penetration.

Although the main cutting blades of the arrowheads of this invention have been depicted as pivotal blades only throughout this specification, it is apparent that fixed blades could be used as main cutting blades as according to this invention.

Although the preferred embodiments of this invention have been depicted as having a plurality of three pivotal blades or main cutting blades each, with only one blade disposed in each corresponding blade slot, it is apparent that the arrowheads according to this invention may have any number of main cutting blades and any number of forward leading penetration enhancing cutting blades or cutting edges as according to this invention, with more than one being preferred. It is also apparent that more than one blade may be housed or contained in a single blade slot - particularly where a straight hinge pin has a plurality of at least two blades attached thereon.

It is apparent that the different and various elements of this invention may be made of light weight and strong materials, such as composites, organic polymers, resilient materials, aluminum alloys, titanium alloys, stainless steels and other metals and materials. It is also apparent that the arrowhead bodies of the arrowheads.of this invention may be fastened to the forward end of an arrow shaft by any method, such as threading into an insert, or glueing thereon.

It is apparent that the different parts and elements and their equivalents of the arrowheads of this invention, as discussed above and according to other preferred embodiments of this invention, can be changed, or interchanged, or eliminated, or duplicated, or made of different materials, and connected to or associated with adjacent elements in different manners, other than suggested herein, without deterring from the desired results of the arrowheads of this invention. For example, arrowheads having at least in part features as disclosed in this specification may be combined with features of the embodiments and spirit of the arrowheads and cutting tips incorporated herein by specific reference.

It is to be understood that the present invention is not limited to the sole embodiments described above, as will be apparent to those skilled in the art, but encompasses the essence of all embodiments, and their legal equivalents, within the scope of the following claims.